

conjunction with the diffuser **3904**. When a hand touches or is near the diffuser **3904**, the image only shows the hand. The background is blurred out. The processor **3912** can process the hand gesture image and send a command to the device under control **3905** based on hand gesture information, for example, described in other embodiments herein. In some embodiments, two imaging sensors **3906** can be used.

[0217] FIG. **40A** is a top view of a switch **4000** having a diffuser, in accordance with some embodiments. FIG. **40B** is a side view of the switch **4000** of FIG. **40A**.

[0218] A plurality of control spots are formed by a diffuser **4004** in some embodiments. When user's hand is placed on the control spots, this indicates that the user intends to control the device in communication with the switch **4000**. In some embodiments, color control spots are placed on the diffuser **4004**. The control spots can be generated by color filters **4006** coated or mounted on the surfaces of the diffuser **4004** in some embodiments. In other embodiments, the control spots can be generated by shining color lights on the control spots. The control spots correspond to function key positions, for example, similar to other embodiments herein.

[0219] The switch **4000** can be useful for machine operation and video gaming in some embodiments. For example, the non-contact controllers **3200** in FIG. **32** can be replaced by two diffuser based controllers: one positioned at the left side of a driver's seat, the other at the right side. The functions keys of the switch **4000** can be the same as those of other switches or controllers described herein except the control spots are located on the surfaces of the diffuser **4004**. Same hand gestures can be used except imaging sensors **4010** are implemented instead of cameras. In this example, the joysticks described in FIG. **32** can be replaced by diffuser based switch/controllers in some embodiments. Joystick functions can be assigned to control spots and hand gestures. FIG. **41** is an illustration of an operator using the diffuser-based controller **4000** of FIG. **40**, in accordance with some embodiments. In replacing the controllers **3200** of FIG. **32**, two diffuser-based controllers **4000** can be provided, one for each hand. A hand gesture **4012** is positioned at the diffuser **4004**, under which one or more control spots are provided corresponding to various function key positions.

[0220] In some embodiment, one of the control spot can be reserved for a tracking mode. When user's hand is placed over this control spot, all other control spots are inactive. A sensor is provided to for tracking a user's hand motion. Tracking will stop when the user inserts a particular hand gesture over the same control spot. Hand tracking can be used in beam steering control in some embodiments. It can also be employed as a mouse for a computer in some embodiments.

[0221] A combination lock used combination of integers to lock and unlock. Hand gestures can be used to represent these integers as illustrated in FIG. **42** in some embodiments. The number panel of a combination lock **4200** is also shown in FIG. **42**. In some embodiments, hand gestures can be used to lock and unlock a door or any device.

[0222] FIG. **43** is an illustration of a diffuser-based hand gesture lock mechanism **4300**, in accordance with some embodiments.

[0223] In some embodiment, the hand gesture lock mechanism **4300** can comprise of a light source **4302**, an imaging sensor **4304**, a diffuser **4306**, and a processor **4312**, which are the same as or similar to those of other switches and

controllers herein. A description thereof is not repeated for brevity. An electromechanical locking/unlocking mechanism **4308** is also provided. For example, if the combination is **5912**, then a hand gesture of 5 fingers is placed near or on the diffuser first, followed by a "pinkyless" hand gesture, proceeded by index finger hand gesture. Index and middle fingers hand gesture is the last hand gesture. Processor **4312** can process the images and generate a command to the electromechanical locking/unlocking mechanism **4308** to unlock the door. The background shown in FIG. **43** is not seen by the imaging sensor because it is smeared out due to its distance from the diffuser.

[0224] While the present inventive concepts have been particularly shown and described above with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art, that various changes in form and detail can be made without departing from the spirit and scope of the present inventive concepts.

What is claimed is:

1. A hand gesture control system, comprising:

a control spot generator that forms a control spot at a surface;

a sensor that senses the presence of a hand in the control spot

at least one hand gesture sensor that provides a field of view for capturing images of a hand gesture at the control spot;

a processor that converts the captured images of the hand gesture into a command signal; and

a transmitter that outputs the command signal to an apparatus that translates the command signal to an action performed by the apparatus.

2. The hand gesture control system of claim 1, wherein the sensor is at least one of a color sensor or a thermal sensor.

3. The hand gesture control system of claim 1, further comprising a display for operating the apparatus, and a plurality of applications that are displayed from the display, which are activated in response to the command signal corresponding to the hand gesture.

4. The hand gesture control system of claim 1, wherein the sensor comprises a visible-thermal dual band camera or multiple cameras for recognizing the hand gesture.

5. The hand gesture control system of claim 1, wherein the processor converts the captured images of the hand gesture into a cursor command signal that controls a cursor at a display.

6. The hand gesture control system of claim 1, wherein the processor converts the captured images of the hand gesture into a joystick command signal that controls the apparatus without interaction with the display.

7. The hand gesture control system of claim 1, wherein the hand gesture control system is constructed and arranged for mounting to a ceiling, a mount, or a head band.

8. The hand gesture control system of claim 1, the control spot is used as a reference beam for separating the hand gesture from a background using a parallax of the hand gesture that is larger than that of the background, which is further away from the cameras, wherein the control spot appears in two different distances before and after inserting a hand into the control spot.

9. A method for providing non-contact switching and controlling an apparatus, comprising: